

AD-A054 426

CENTER FOR NAVAL ANALYSES ARLINGTON VA

F/G 5/2

COMMENTS ON: PRINCIPLES OF INFORMATION RETRIEVAL BY MANFRED KOC--ETC(U)

UNCLASSIFIED

MAR 78 R C COILE

CNA-PP-215

NL

| OF |
AD
AD54426

END
DATE
FILED
6 -78
DDC

55 000215.00

AD A 054426

AD No. _____
DDC FILE COPY

COMMENTS ON: *PRINCIPLES OF INFORMATION RETRIEVAL*
by Manfred Kochen

Q
B.S.

Russell C. Coile

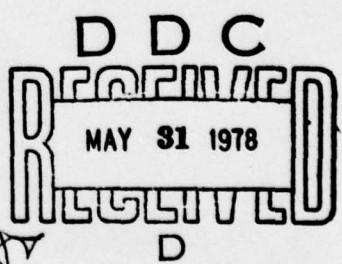
Professional Paper No. 215

March 1978

The ideas expressed in this paper are those of the author. The paper does not necessarily represent the views of the Center for Naval Analyses.

CENTER FOR NAVAL ANALYSES

1401 Wilson Boulevard
Arlington, Virginia 22209



DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

(14)

CNA-PP-215

(9)

PROFESSIONAL PAPER, NO. 215

(6)

COMMENTS ON: PRINCIPLES OF INFORMATION RETRIEVAL
by Manfred Kochen.

(10)

Russell C. Coile

(11)

6 Mar 1978

(12)

17 p.

Center for Naval Analyses
University of Rochester
Arlington, Virginia

Centre for Information Science
The City University
London, England

ACCESSION for	
NTIS	White Section <input checked="" type="checkbox"/>
DDO	Buff Section <input type="checkbox"/>
TRANSMISSIONS	
IDENTIFICATION.....	
BY.....	
DISTRIBUTION/AVAILABILITY CODES	
DIST.	AVAIL. and/or SPECIAL
A	

(Published as a Letter to the Editor, Journal of Documentation,
Vol. 31, No. 4, pages 298-301, December 1975)

077 270

MLF

ABSTRACT

Mathematical errors in Manfred Kochen's book, Principles of Information Retrieval, give the reader the erroneous impression that the log-normal distribution is a better fit than Yule's Beta-function distribution for predicting frequency distributions of scientific productivity of econometricians and mathematicians. Correction of these errors suggests that the Beta function gives a better fit.

COMMENTS ON: PRINCIPLES OF INFORMATION RETRIEVAL

by Manfred Kochen

Kochen's ⁽¹⁾ book, Principles of Information Retrieval, was recently reviewed in the Journal of Documentation by Vickery ⁽²⁾. The review was concluded with the statement, "All who are concerned with the future development of information science will have something to learn from this book." Indeed, I learned a great deal while trying to sift out misinformation from information in the section called "Authorship." In view of the kind endorsement by a distinguished reviewer, I hesitate to sound a discordant note, but, in an effort to assist other readers who might have become confused by this section, may I point out some of the errors?

On page 85 of this book, Kochen makes the following statement:

"It is asserted (Learnes, 1953) for example, that the number of authors who published exactly r papers in Econometrica over a 20-year period is approximately a^{r-k} ."

First, the name was Dickson H. Leavens ⁽³⁾, not Learnes. Second, he did not assert any formula. He did present a table of data giving the cumulative frequency distribution of contributors to Econometrica and a figure showing this cumulative number of contributors plotted versus the number of contributions on log-log graph paper. Leavens commented that the slope of the

straight line that he had drawn in freehand with what he termed "a fair fit for all but the last three points" was approximately -1.5, as he expected in accordance with Pareto theory.

Third, if he had presented a formula, it would certainly not have been a^{r-k} but would probably have been ar^{-k} . By curious coincidence, Sawyer⁽⁴⁾ gives an example of a mistake remarkably similar to this one in his discussion of the detection of mathematical misprints. As a matter of interest, an expression based on all but the last three points is $868r^{-1.56}$. Fourth, this expression with Leavens' exponent of approximately -1.5 is for the cumulative number of authors who have contributed "at least r " papers in the Pareto sense, and the factors are not those for Kochen's "exactly r " papers in the Lotka⁽⁵⁾ sense. For "exactly r " papers, we would have $389r^{-1.94}$, based on all but the last three data points.

On page 86, Table 4.1 purports to give the number of authors contributing r papers to Econometrica over a 20-year period. First, the column heading for r , which reads "11," is wrong. This should be "11 or more" or "greater than 10," but not simply "11." Second, all the numbers given, i.e., 824, 217, 94, 50, etc., are wrong. The correct numbers, as obtained from Leavens' Table I, are given in a proposal for a revised Table 4.1 for Econometricians at the end of this letter. Third, as a matter of interest to Sherlock Holmes fans, the numbers 824, 217, 94, 50, etc.,

are not for econometricians but are estimates of the number of physicists making important contributions in physics throughout history up to the year 1900. These estimates for physicists are to be found in a paper by Simon⁽⁶⁾. In Simon's paper, a column for "estimate" of physicists is adjacent to a column for "actual" econometricians, and was apparently copied by mistake. Fourth, as further evidence of the source of these erroneous numbers (824, 217, etc.), Simon's table only goes up to "11 or more" contributions, while Leavens' table goes right on up to 46 contributions.

On page 85, there is a statement:

"Some data has been compiled (Davis, 1941)
to show that the number of authors, in a sample
of authors who have written r papers, fits a
Yule-type distribution."

First, Davis⁽⁷⁾ never mentioned Yule or the Yule-type distribution. Harold T. Davis, a research associate of the Cowles Commission for Research in Economics, examined previously published data on scientific productivity of mathematicians, chemists, and physicists in an effort to find statistical support for his Pareto-type law of distribution of special abilities. Davis studied the data on scientific productivity of mathematicians published by Arnold Dresden⁽⁸⁾. Davis grouped Dresden's data into intervals of 7 centering on the central value, accumulated the number of authors, and fitted a parabolic curve to the accumulation obtaining:

$$\log y = 3.74877 - 2.11012 \log x$$

where y is the number of persons making at least x contributions. It should be noted that the slope Davis obtained of 2.11 was much larger than the normal 1.5 usually associated with the Pareto law.

Second, G. Udny Yule⁽⁹⁾ developed a probability model in 1924 in connection with analysis of the distribution of biological genera by number of species. Herbert A. Simon studied this Beta-function model and proposed its possible application as a distribution function for scientific publications, calling it the "Yule" distribution. This was in 1955, some years after Davis' book was published in 1941.

Third, since Kochen neither described the "Yule" distribution nor referenced Simon's application of it to scientific productivity, it might be desirable for someone to explain what it is. Simon's "Yule" distribution is a Beta-function probability model,

$$f(i) = A B(i, \rho + 1)$$

where $f(i)$ is the number of authors contributing a given number, i , of papers to journals

A and ρ are constants and

$B(i, \rho + 1)$ is the Beta-function of $i, \rho + 1$.

In Simon's notation,

$$\rho = \frac{1}{1 + \alpha}$$

where $\alpha = \frac{n_k}{k}$

n_k is total authors

k is total papers

$$B(i, \rho + 1) = \int_0^1 \lambda^{i-1} (1 - \lambda^\rho) d\lambda = \frac{\Gamma(i) \Gamma(\rho + 1)}{\Gamma(i + \rho + 1)} \quad (0 < i, 0 < \rho < \infty).$$

Simon derived the estimated frequencies from his equations (2.11) and (2.21) which are

$$\beta(i) = \frac{(1 - \alpha)(i - 1)}{1 + (1 - \alpha)i} = \frac{f^*(i)}{f^*(i - 1)} \quad (2.11)$$

$(i = 2, \dots, k)$

$$f^*(1) = \frac{k\alpha}{2 - \alpha} = \frac{n_k}{2 - \alpha} . \quad (2.21)$$

Fourth, Simon tested his Yule distribution on four sets of scientific productivity data which he had found published earlier by Davis and Leavens. This included Davis' collection of Dresden's data on mathematicians and Lotka's data on chemists and physicists as well as Leavens' data on econometricians. In Simon's paper, the seventh column of his Table 3 contained the Yule estimates of physicists which was adjacent to the eighth column which contained the actual numbers of econometricians, as was mentioned earlier.

On page 86, there is a statement,

"The log-normal distribution, on the other hand, gives a better fit than the Yule distribution to the data shown in Table 4.1."

First, Table 4.1 does not give estimates for mathematicians and econometricians calculated by either the log-normal distribution or the Yule distribution. It is impossible, therefore, to compare either estimates with the actual numbers of authors given. Second, there are no goodness-of-fit calculations given to support the opinion that the log-normal distribution is better than the Yule distribution. Third, Simon, in discussing qualitatively his Yule distribution, stated,

"The fit is reasonably good, when it is remembered that only one parameter is available for adjustment. However, it should be noted that the estimated frequencies tend to be too high for $i = 1, 2$ and too low for $i = 3, \dots, 10$. In three of the four cases, they are again too high for the tails of the distributions. A further refinement of the model is apparently needed to remove these discrepancies."

Fourth, a proposed revision of Table 4.1, which includes the estimated Yule distribution for mathematicians, is given

below. Since Simon, for some unknown reason, did not provide a Yule estimate of the number of mathematicians making one contribution, a computer-generated Yule distribution is given as well as Simon's incomplete Yule distribution. A chi-square goodness-of-fit calculation has therefore been made using the computer's Yule distribution, which has a value of 31.5. For 7 degrees of freedom, the 0.05 level is 14.1, which shows that the Yule distribution is a poor fit, as Simon predicted. However, estimates of the log-normal distribution with χ^2 of 93.1 show it to be a terrible fit in contrast to Kochen's opinion that the log-normal was better than the Yule. Finally, a proposed revision of Table 4.1, to include the estimated Yule distribution for econometricians, is also given below. The computer's Yule estimates differ slightly from Simon's estimates. Again, the Yule fit is poor but better than the terrible fit of the log-normal estimates.

REVISED TABLE 4.1 FOR MATHEMATICIANS

<i>r</i>	Number of authors contributing <i>r</i> papers to the Chicago Section of American Math Society over 25-year period	Simon's Yule estimate	Computer's Yule estimate	Log-normal estimate
1	133	-	158.6	66.6
2	43	46	47.7	27.7
3	24	23	22.0	15.8
4	12	14	12.4	10.4
5	11	10	7.8	7.3
6	14	7	5.4	9.7
7	5	5	3.9	
8	3	4	2.9	8.4
9	9	3	2.2	
10	1	3	1.8	
11 or more	23	30	13.4	19.4
			$\chi^2 31.5$	$\chi^2 93.1$

for d of f = 7

.05 level R: $\chi^2 \geq 14.1$

REVISED TABLE 4.1 FOR ECONOMETRICIANS

<i>r</i>	Number of authors contributing <i>r</i> papers to <i>Econometrica</i> over 20-year period	Simon's Yule estimate	Computer's Yule estimate	Log-normal estimate
1	436	453	453.4	195.2
2	107	119	122.7	74.9
3	61	51	52.3	39.8
4	40	27	27.5	24.5
5	14	16	16.5	16.5
6	23	11	10.7	20.5
7	6	7	7.4	
8	11	5	5.3	
9	1	4	4.0	16.2
10	0	3	3.1	
11 or more	22	25	18.1	27.5
		$\chi^2 23.9$	$\chi^2 25.4$	$\chi^2 338.0$

for d of f = 8

.05 level R: $\chi^2 \geq 15.5$

REFERENCES

1. Kochen, Manfred, Principles of information retrieval, Los Angeles 1974.
2. Vickery, B. C., Review of Principles of information retrieval, Journal of Documentation, 31, 1975, p. 50.
3. Leavens, Dickson H., "Contributors to Econometrica, Vols. 1-20," Econometrica, 21, 1953, pp 630-632.
4. Sawyer, W. W., The Search for Pattern, Middlesex 1970, pp 99-100.
5. Lotka, A. J., "The frequency distribution of scientific productivity," Journal of the Washington Academy of Sciences, 16 (no. 12), 1926, pp 317-323.
6. Simon, Herbert A., "On a class of skew distribution functions," Biometrika, 42, 1955, pp 425-440.
7. Davis, Harold T., The analysis of economic time series, Principia Press, Bloomington, Indiana 1941.
8. Dresden, Arnold, "A report on the scientific work of the Chicago Section 1897-1922," Bulletin of the American Mathematical Society, 28, 1922, pp 303-307.
9. Yule, G. Udny, "A mathematical theory of evolution, based on the conclusions of Dr. J. C. Willis, F.R.S.," Philosophical Transactions of the Royal Society of London, pp. 21-87.

CNA Professional Papers — 1973 to Present*

- PP 103**
 Friedheim, Robert L., "Political Aspects of Ocean Ecology" 48 pp., Feb 1973, published in Who Protects the Oceans, John Lawrence Hargrove (ed.) (St. Paul: West Publ'g Co., 1974), published by the American Society of International Law) AD 757 936
- PP 104**
 Schick, Jack M., "A Review of James Cable, Gunboat Diplomacy Political Applications of Limited Naval Forces," 5 pp., Feb 1973, (Reviewed in the American Political Science Review, Vol. LXVI, Dec 1972)
- PP 105**
 Corn, Robert J. and Phillips, Gary R., "On Optimal Correction of Gunfire Errors," 22 pp., Mar 1973, AD 761 674
- PP 106**
 Stoloff, Peter H., "User's Guide for Generalized Factor Analysis Program (FACTAN)," 35 pp., Feb 1973, (Includes an addendum published Aug 1974) AD 758 824
- PP 107**
 Stoloff, Peter H., "Relating Factor Analytically Derived Measures to Exogenous Variables," 17 pp., Mar 1973, AD 758 820
- PP 108**
 McConnell, James M. and Kelly, Anne M., "Super-power Naval Diplomacy in the Indo-Pakistani Crisis," 14 pp., 5 Feb 1973, (Published, with revisions, in Survival, Nov/Dec 1973) AD 761 675
- PP 109**
 Berghofer, Fred G., "Salaries—A Framework for the Study of Trend," 8 pp., Dec 1973, (Published in Review of Income and Wealth, Series 18, No. 4, Dec 1972)
- PP 110**
 Augusta, Joseph, "A Critique of Cost Analysis," 9 pp., Jul 1973, AD 766 376
- PP 111**
 Herrick, Robert W., "The USSR's 'Blue Belt of Defense' Concept: A Unified Military Plan for Defense Against Seaborne Nuclear Attack by Strike Carriers and Polaris/Poseidon SSBNs," 18 pp., May 1973, AD 766 375
- PP 112**
 Ginsberg, Lawrence H., "ELF Atmosphere Noise Level Statistics for Project SANGUINE," 29 pp., Apr 1974, AD 786 969
- PP 113**
 Ginsberg, Lawrence H., "Propagation Anomalies During Project SANGUINE Experiments," 5 pp., Apr 1974, AD 786 968
- PP 114**
 Malone, Arthur P., "Job Satisfaction and Job Turnover," 41 pp., Jul 1973, AD 768 410
- PP 115**
 Silverman, Lester P., "The Determinants of Emergency and Elective Admissions to Hospitals," 145 pp., 18 Jul 1973, AD 766 377
- PP 116**
 Rehm, Allan S., "An Assessment of Military Operations Research in the USSR," 19 pp., Sep 1973, (Reprinted from Proceedings, 30th Military Operations Research Symposium (U), Secret Dec 1972) AD 770 116
- PP 117**
 McWhite, Peter B. and Ratliff, H. Donald,* "Defending a Logistics System Under Mining Attack," ** 24 pp., Aug 1976 (to be submitted for publication in Naval Research Logistics Quarterly), presented at 44th National Meeting, Operations Research Society of America, November 1973, AD A030 454
 *University of Florida.
 **Research supported in part under Office of Naval Research Contract N00014-68-0273-0017
- PP 118**
 Barfoot, C. Bernard, "Markov Duels," 18 pp., Apr 1973, (Reprinted from Operations Research, Vol. 22, No. 2, Mar-Apr 1974)
- PP 119**
 Stoloff, Peter and Lockman, Robert F., "Development of Navy Human Relations Questionnaire," 2 pp., May 1974, (Published in American Psychological Association Proceedings, 81st Annual Convention, 1973) AD 779 240
- PP 120**
 Smith, Michael W. and Schrimper, Ronald A.,* "Economic Analysis of the Intrinsic Dispersion of Criminal Activity," 30 pp., Jun 1974, (Presented at the Econometric Society Meetings, 30 Dec 1973) AD 780 538
 *Economics, North Carolina State University.
- PP 121**
 Devine, Eugene J., "Procurement and Retention of Navy Physicians," 21 pp., Jun 1974, (Presented at the 49th Annual Conference, Western Economic Association, Las Vegas, Nev., 10 Jun 1974) AD 780 539
- PP 122**
 Kelly, Anne M., "The Soviet Naval Presence During the Iraq-Kuwaiti Border Dispute: March-April 1973," 34 pp., Jun 1974, (Published in Soviet Naval Policy, ed. Michael McGwire; New York: Praeger) AD 780 592
- PP 123**
 Petersen, Charles C., "The Soviet Port-Clearing Operation in Bangladesh, March 1972-December 1973," 35 pp., Jun 1974, (Published in Michael McGwire, et al. (eds) Soviet Naval Policy: Objectives and Constraints, (New York: Praeger Publishers, 1974) AD 780 540)
- PP 124**
 Friedheim, Robert L. and Jahn, Mary E., "Anticipating Soviet Behavior at the Third U.N. Law of the Sea Conference: USSR Positions and Dilemmas," 37 pp., 10 Apr 1974, (Published in Soviet Naval Policy, ed. Michael McGwire; New York: Praeger) AD 783 701
- PP 125**
 Weinland, Robert G., "Soviet Naval Operations—Ten Years of Change," 17 pp., Aug 1974, (Published in Soviet Naval Policy, ed. Michael McGwire; New York: Praeger) AD 783 962
- PP 126 – Classified.**
- PP 127**
 Dragich, George S., "The Soviet Union's Quest for Access to Naval Facilities in Egypt Prior to the June War of 1967," 64 pp., Jul 1974, AD 786 318
- PP 128**
 Stoloff, Peter and Lockman, Robert F., "Evaluation of Naval Officer Performance," 11 pp., (Presented at the 82nd Annual Convention of the American Psychological Association, 1974) Aug 1974, AD 784 012
- PP 129**
 Holen, Arlene and Horowitz, Stanley, "Partial Unemployment Insurance Benefits and the Extent of Partial Unemployment," 4 pp., Aug 1974, (Published in the Journal of Human Resources, Vol. IX, No. 3, Summer 1974) AD 784 010
- PP 130**
 Dimukas, Bradford, "Roles and Missions of Soviet Naval General Purpose Forces in Wartime: Pro-SSBN Operation," 20 pp., Aug 1974, AD 786 320
- PP 131**
 Weinland, Robert G., "Analysis of Gorshkov's Navies in War and Peace," 45 pp., Aug 1974, (Published in Soviet Naval Policy, ed. Michael McGwire; New York: Praeger) AD 786 319
- PP 132**
 Kleinman, Samuel D., "Racial Differences in Hours Worked in the Market: A Preliminary Report," 77 pp., Feb 1975, (Paper read on 26 Oct 1974 at Eastern Economic Association Convention in Albany, N.Y.) AD A 005 517
- PP 133**
 Squires, Michael L., "A Stochastic Model of Regime Change in Latin America," 42 pp., Feb 1975, AD A 007 912
- PP 134**
 Root, R. M. and Cunniff, P. F.,* "A Study of the Shock Spectrum of a Two-Degree-of-Freedom Non-linear Vibratory System," 39 pp., Dec 1975, (Published in the condensed version of the Journal of the Acoustic Society, Vol 60, No. 6, Dec 1976, pp. 1314
 *Department of Mechanical Engineering, University of Maryland.
- PP 135**
 Goudreau, Kenneth A.; Kuzmack, Richard A.; Wiedemann, Karen, "Analysis of Closure Alternatives for Naval Stations and Naval Air Stations," 47 pp., 3 Jun 1975 (Reprinted from "Hearing before the Subcommittee on Military Construction of the Committee on Armed Service," U.S. Senate, 93rd Congress, 1st Session, Part 2, 22 Jun 1973)
- PP 136**
 Stallings, William, "Cybernetics and Behavior Therapy," 13 pp., Jun 1975
- PP 137**
 Petersen, Charles C., "The Soviet Union and the Reopening of the Suez Canal: Mineclearing Operations in the Gulf of Suez," 30 pp., Aug 1975, AD A 015 376

*CNA Professional Papers with an AD number may be obtained from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151. Other papers are available from the author at the Center for Naval Analyses, 1401 Wilson Boulevard, Arlington, Virginia 22209.

CNA Professional Papers — 1973 to Present (Continued)

- PP 138**
Stallings, William, "BRIDGE: An Interactive Dialogue-Generation Facility," 5 pp., Aug 1975 (Reprinted from *IEEE Transactions on Systems, Man, and Cybernetics*, Vol. 5, No. 3, May 1975)
- PP 139**
Morgan, William F., Jr., "Beyond Folklore and Fables in Forestry to Positive Economics," 14 pp., (Presented at Southern Economic Association Meetings November, 1974) Aug 1975, AD A 015 293
- PP 140**
Mahoney, Robert and Druckman, Daniel*, "Simulation, Experimentation, and Context," 36 pp., 1 Sep 1975, (Published in *Simulation & Games*, Vol. 6, No. 3, Sep 1975)
**Mathematica, Inc.*
- PP 141**
Mizrahi, Maurice M., "Generalized Hermite Polynomials,"* 5 pp., Feb 1976 (Reprinted from the *Journal of Computational and Applied Mathematics*, Vol. 1, No. 4 (1975), 273-277).
**Research supported by the National Science Foundation*
- PP 142**
Lockman, Robert F., Juhn, Christopher, and Shughart, William F. II, "Models for Estimating Premature Losses and Recruiting District Performance," 36 pp., Dec 1975 (Presented at the RAND Conference on Defense Manpower, Feb 1976; to be published in the conference proceedings) AD A 020 443
- PP 143**
Horowitz, Stanley and Sherman, Allan (LCDR, USN), "Maintenance Personnel Effectiveness in the Navy," 33 pp., Jan 1976 (Presented at the RAND Conference on Defense Manpower, Feb 1976; to be published in the conference proceedings) AD A021 581
- PP 144**
Durch, William J., "The Navy of the Republic of China — History, Problems, and Prospects," 66 pp., Aug 1976 (To be published in "A Guide to Asiatic Fleets," ed. by Barry M. Blechman; Naval Institute Press) AD A030 460
- PP 145**
Kelly, Anne M., "Port Visits and the "Internationalist Mission" of the Soviet Navy," 36 pp., Apr 1976 AD A023 436
- PP 146**
Palmour, Vernon E., "Alternatives for Increasing Access to Scientific Journals," 6 pp., Apr 1975 (Presented at the 1975 IEEE Conference on Scientific Journals, Cherry Hill, N.C., Apr 28-30; published in *IEEE Transactions on Professional Communication*, Vol. PC-18, No. 3, Sep 1975) AD A021 798
- PP 147**
Kessler, J. Christian, "Legal Issues in Protecting Offshore Structures," 33 pp., Jun 1976 (Prepared under task order N00014-68-A-0091-0023 for ONR) AD A028 389
- PP 148**
McConnell, James M., "Military-Political Tasks of the Soviet Navy in War and Peace," 62 pp., Dec 1975 (Published in Soviet Oceans Development Study of Senate Commerce Committee October 1976) AD A022 590
- PP 149**
Squires, Michael L., "Counterforce Effectiveness: A Comparison of the Tsipis "K" Measure and a Computer Simulation," 24 pp., Mar 1976 (Presented at the International Study Association Meetings, 27 Feb 1976) AD A022 591
- PP 150**
Kelly, Anne M. and Petersen, Charles, "Recent Changes in Soviet Naval Policy: Prospects for Arms Limitations in the Mediterranean and Indian Ocean," 28 pp., Apr 1976, AD A 023 723
- PP 151**
Horowitz, Stanley A., "The Economic Consequences of Political Philosophy," 8 pp., Apr 1976 (Reprinted from *Economic Inquiry*, Vol. XIV, No. 1, Mar 1976)
- PP 152**
Mizrahi, Maurice M., "On Path Integral Solutions of the Schrodinger Equation, Without Limiting Procedure,"* 10 pp., Apr 1976 (Reprinted from *Journal of Mathematical Physics*, Vol. 17, No. 4 (Apr 1976), 566-575).
**Research supported by the National Science Foundation*
- PP 153**
Mizrahi, Maurice M., "WKB Expansions by Path Integrals, With Applications to the Anharmonic Oscillator,"* 137 pp., May 1976 (Submitted for publication in *Annals of Physics*) AD A025 440
**Research supported by the National Science Foundation*
- PP 154**
Mizrahi, Maurice M., "On the Semi-Classical Expansion in Quantum Mechanics for Arbitrary Hamiltonians," 19 pp., May 1976 (To appear in the *Journal of Mathematical Physics*) AD A025 441
- PP 155**
Squires, Michael L., "Soviet Foreign Policy and Third World Nations," 26 pp., Jun 1976 (Prepared for presentation at the Midwest Political Science Association meetings, Apr 30, 1976) AD A028 388
- PP 156**
Stallings, William, "Approaches to Chinese Character Recognition," 12 pp., Jun 1976 (Reprinted from *Pattern Recognition* (Pergamon Press), Vol. 8, pp. 87-98, 1976) AD A028 692
- PP 157**
Morgan, William F., "Unemployment and the Pentagon Budget: Is There Anything in the Empty Pork Barrel?" 20 pp., Aug 1976 AD A030 455
- PP 158**
Haskell, LCDR. Richard D. (USN), "Experimental Validation of Probability Predictions," 25 pp., Aug 1976 (Presented at the Military Operations Research Society Meeting, Fall 1976) AD A030 458
- PP 159**
McConnell, James M., "The Gorshkov Articles, The New Gorshkov Book and Their Relation to Policy," 93 pp., Jul 1976 (To be printed in *Soviet Naval Influence: Domestic and Foreign Dimensions*, ed. by M. McCwire and J. McDonnell; New York: Praeger) AD A029 227
- PP 160**
Wilson, Desmond P., Jr., "The U.S. Sixth Fleet and the Conventional Defense of Europe," 50 pp., Sep 1976 (Submitted for publication in *Adelphi Papers*, I.I.S.S., London) AD A030 457
- PP 161**
Melich, Michael E. and Peet, Vice Adm. Ray (USN, Retired), "Fleet Commanders: Afloat or Ashore?" 9 pp., Aug 1976 (Reprinted from *U.S. Naval Institute Proceedings*, Jun 1976) AD A030 456
- PP 162**
Friedheim, Robert L., "Parliamentary Diplomacy," 106 pp. Sep 1976 AD A033 306
- PP 163**
Lockman, Robert F., "A Model for Predicting Recruit Losses," 9 pp., Sep 1976 (Presented at the 84th annual convention of the American Psychological Association, Washington, D.C., 4 Sep 1976) AD A030 459
- PP 164**
Mahoney, Robert B., Jr., "An Assessment of Public and Elite Perceptions in France, The United Kingdom, and the Federal Republic of Germany, 31 pp., Feb 1977 (Presented at Conference "Perception of the U.S. — Soviet Balance and the Political Uses of Military Power" sponsored by Director, Advanced Research Projects Agency, April 1976) AD 036 599
- PP 165**
Jondrow, James M., "Effects of Trade Restrictions on Imports of Steel," 67 pp., November 1976, (Delivered at ILAB Conference in Dec 1976)
- PP 166**
Feldman, Paul, "Impediments to the Implementation of Desirable Changes in the Regulation of Urban Public Transportation," 12 pp., Oct 1976, AD A033 322
- PP 166 — Revised**
Feldman, Paul, "Why It's Difficult to Change Regulation," Oct 1976
- PP 167**
Kleinman, Samuel, "ROTC Service Commitments: a Comment," 4 pp., Nov 1976, (To be published in *Public Choice*, Vol. XXIV, Fall 1976) AD A033 305
- PP 168**
Lockman, Robert F., "Revalidation of CNA Support Personnel Selection Measures," 36 pp., Nov 1976
- PP 169**
Jacobson, Louis S., "Earnings Losses of Workers Displaced from Manufacturing Industries," 38 pp., Nov 1976, (Delivered at ILAB Conference in Dec 1976)
- PP 170**
Brechling, Frank P., "A Time Series Analysis of Labor Turnover," Nov 1976, (Delivered at ILAB Conference in Dec 1976)
- PP 171**
Ralston, James M., "A Diffusion Model for GaP Red LED Degradation," 10 pp., Nov 1976, (Published in *Journal of Applied Physics*, Vol. 47, pp. 4518-4527, Oct 1976)
- PP 172**
Classen, Kathleen P., "Unemployment Insurance and the Length of Unemployment," Dec 1976, (Presented at the University of Rochester Labor Workshop on 16 Nov 1976)
- PP 173**
Kleinman, Samuel D., "A Note on Racial Differences in the Added-Worker/Discouraged-Worker Controversy," 2 pp., Dec 1976, (Published in the *American Economist*, Vol. XX, No. 1, Spring 1976)

CNA Professional Papers – 1973 to Present (Continued)

- PP 174** Mahoney, Robert B., Jr., "A Comparison of the Brookings and International Incidents Projects," 12 pp. Feb 1977 AD 037 206
- PP 175** Levine, Daniel; Stoloff, Peter and Spruill, Nancy, "Public Drug Treatment and Addict Crime," June 1976, (Published in Journal of Legal Studies, Vol. 5, No. 2)
- PP 176** Felix, Wendi, "Correlates of Retention and Promotion for USNA Graduates," 38 pp., Mar 1977
- PP 177** Lockman, Robert F. and Warner, John T., "Predicting Attrition: A Test of Alternative Approaches," 33 pp. Mar 1977. (Presented at the OSD/ONR Conference on Enlisted Attrition Xerox International Training Center, Leesburg, Virginia, 4-7 April 1977)
- PP 178** Kleinman, Samuel D., "An Evaluation of Navy Unrestricted Line Officer Accession Programs," 23 pp. April 1977, (To be presented at the NATO Conference on Manpower Planning and Organization Design, Stresa, Italy, 20 June 1977)
- PP 179** Stoloff, Peter H. and Balut, Stephen J., "Vacate: A Model for Personnel Inventory Planning Under Changing Management Policy," 14 pp. April 1977, (To be presented at the NATO Conference on Manpower Planning and Organization Design, Stresa, Italy, 20 June 1977)
- PP 180** Horowitz, Stanley A. and Sherman, Allan, "The Characteristics of Naval Personnel and Personnel Performance," 16 pp. April 1977, (To be presented at the NATO Conference on Manpower Planning and Organization Design, Stresa, Italy, 20 June 1977)
- PP 181** Balut, Stephen J. and Stoloff, Peter, "An Inventory Planning Model for Navy Enlisted Personnel," 35 pp., May 1977, (Prepared for presentation at the Joint National Meeting of the Operations Research Society of America and The Institute for Management Science, 9 May 1977, San Francisco, California)
- PP 182** Murray, Russell, 2nd, "The Quest for the Perfect Study or My First 1138 Days at CNA," 57 pp., April 1977
- PP 183** Kassing, David, "Changes in Soviet Naval Forces," 33 pp., November, 1976, (To be published as a chapter in a book published by The National Strategic Information Center)
- PP 184** Lockman, Robert F., "An Overview of the OSD/ONR Conference on First Term Enlisted Attrition," 22 pp., June 1977, (Presented to the 39th MORS Working Group on Manpower and Personnel Planning, Annapolis, Md., 28-30 June 1977)
- PP 185** Kassing, David, "New Technology and Naval Forces in the South Atlantic," 22 pp. (This paper was the basis for a presentation made at the Institute for Foreign Policy Analyses, Cambridge, Mass., 28 April 1977.)
- PP 186** Mizrahi, Maurice M., "Phase Space Integrals, Without Limiting Procedure," 31 pp., May 1977, (Submitted for publication in Journal of Mathematical Physics)
- PP 187** Coile, Russell C., "Nomography for Operations Research," 35 pp., April 1977, (Presented at the Joint National Meeting of the Operations Research Society of America and The Institute for Management Services, San Francisco, California, 9 May 1977)
- PP 188** Dorch, William J., "Information Processing and Outcome Forecasting for Multilateral Negotiations: Testing One Approach," 53 pp., May 1977 (Prepared for presentation to the 18th Annual Convention of the International Studies Association, Chase-Park Plaza Hotel, St. Louis, Missouri, March 16-20, 1977)
- PP 189** Coile, Russell C., "Error Detection in Computerized Information Retrieval Data Bases," July, 1977, 13 pp. Presented at the Sixth Cranfield International Conference on Mechanized Information Storage and Retrieval Systems, Cranfield Institute of Technology, Cranfield, Bedford, England, 26-29 July 1977
- PP 190** Mahoney, Robert B., Jr., "European Perceptions and East-West Competition," 96 pp., July 1977 (Prepared for presentation at the annual meeting of the International Studies Association, St. Louis, Mo., March, 1977)
- PP 191** Sawyer, Ronald, "The Independent Field Assignment: One Man's View," August 1977, 25 pp.
- PP 192** Holen, Arlene, "Effects of Unemployment Insurance Entitlement on Duration and Job Search Outcome," August 1977, 6 pp., (Reprinted from Industrial and Labor Relations Review, Vol. 30, No. 4, Jul 1977)
- PP 193** Horowitz, Stanley A., "A Model of Unemployment Insurance and the Work Test," August 1977, 7 pp. (Reprinted from Industrial and Labor Relations Review, Vol. 30, No. 40, Jul 1977)
- PP 194** Classen, Kathleen P., "The Effects of Unemployment Insurance on the Duration of Unemployment and Subsequent Earnings," August 1977, 7 pp. (Reprinted from Industrial and Labor Relations Review, Vol. 30, No. 40, Jul 1977)
- PP 195** Brechling, Frank, "Unemployment Insurance Taxes and Labor Turnover: Summary of Theoretical Findings," 12 pp. (Reprinted from Industrial and Labor Relations Review, Vol. 30, No. 40, Jul 1977)
- PP 196** Ralston, J. M. and Lorimer, O. G., "Degradation of Bulk Electroluminescent Efficiency in Zn, O-Doped GaP LED's," July 1977, 3 pp. (Reprinted from IEEE Transactions on Electron Devices, Vol. ED-24, No. 7, July 1977)
- PP 197** Wells, Anthony R., "The Centre for Naval Analyses," 14 pp., Dec 1977
- PP 199** Dorch, William J., "Revolution From A F.A.R. – The Cuban Armed Forces in Africa and the Middle East," Sep 1977, 16 pp.
- PP 200** Powers, Bruce F., "The United States Navy," 40 pp. Dec 1977. (To be published in American Military Machine)
- PP 201** Dorch, William J., "The Cuban Military in Africa and The Middle East: From Algeria to Angola," Sep 1977, 67 pp.
- PP 202** Feldman, Paul, "Why Regulation Doesn't Work," (Reprinted from *Technological Change and Welfare in the Regulated Industries and Review of Social Economy*, Vol. XXIX, March, 1971, No. 1.) Sep 1977, 8 pp.
- PP 203** Feldman, Paul, "Efficiency, Distribution, and the Role of Government in a Market Economy," (Reprinted from *The Journal of Political Economy*, Vol. 79, No. 3, May/June 1971.) Sep 1977, 19 pp.
- PP 204** Wells, Anthony R., "The 1967 June War: Soviet Naval Diplomacy and The Sixth Fleet – A Re-appraisal," Oct 1977, 36 pp.
- PP 205** Coile, Russell C., "A Bibliometric Examination of the Square Root Theory of Scientific Publication Productivity," (Presented at the annual meeting of the American Society for Information Science, Chicago, Illinois, 29 September 1977.) Oct 1977, 6 pp.
- PP 206** McConnell, James M., "Strategy and Missions of the Soviet Navy in the Year 2000," 48 pp., Nov 1977, (To be presented at a Conference on Problems of Sea Power as we Approach the 21st Century, sponsored by the American Enterprise Institute for Public Policy Research, 6 October 1977, and subsequently published in a collection of papers by the Institute)

CNA Professional Papers - 1973 to Present (Continued)

PP 207

Goldberg, Lawrence, "Cost-Effectiveness of Potential Federal Policies Affecting Research & Development Expenditures in the Auto, Steel and Food Industries," 36 pp., Oct 1977, (Presented at Southern Economic Association Meetings beginning 2 November 1977)

PP 208

Roberts, Stephen S., "The Decline of the Overseas Station Fleets: The United States Asiatic Fleet and the Shanghai Crisis, 1932," 18 pp., Nov 1977, (Reprinted from The American Neptune, Vol. XXXVII., No. 3, July 1977)

PP 209 - Classified.

PP 210

Kassing, David, "Protecting The Fleet," 40 pp., Dec 1977 (Prepared for the American Enterprise Institute Conference on Problems of Sea Power as We Approach the 21st Century, October 6-7, 1977)

PP 211

Mizrahi, Maurice M., "On Approximating the Circular Coverage Function," 14 pp., Feb 1978

PP 213

Mangel, Marc, "Fluctuations in Systems with Multiple Steady States. Application to Lanchester Equations," 12 pp., Feb 78, (Presented at the First Annual Workshop on the Information Linkage Between Applied Mathematics and Industry, Naval PG School, Feb 23-25, 1978)

PP 215

Code, Russell C., "Comments on: *Principles of Information Retrieval* by Manfred Kochen," 10 pp., Mar 78, (Published as a Letter to the Editor, Journal of Documentation, Vol. 31, No. 4, pages 298-301, December 1975)

PP 216

Code, Russell C., "Lotka's Frequency Distribution of Scientific Productivity," 18 pp., Feb 1978, (Published in the Journal of the American Society for Information Science, Vol. 28, NO. 6, pp. 366-370, November 1977)

PP 217

Code, Russell C., "Bibliometric Studies of Scientific Productivity," 17 pp., Mar 78, (Presented at the Annual meeting of the American Society for Information Science held in San Francisco, California, October 1976.)

PP 218 - Classified.

PP 219

Huntzinger, R. LaVar, "Market Analysis with Rational Expectations: Theory and Estimation," 60 pp., Apr 78 (To be submitted for publication in Journal of Econometrics)

PP 220

Maurer, Don, "Diagonalization by Group Matrices," 26 pp., Apr 78